Internet addiction in Japanese college students: Is Japanese version of Internet Addiction Test (JIAT) useful as a screening tool?

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Abstract

Background: Due to lack of evidence of Internet addiction (IA) in Japan, we investigated IA and examined the utility of the Japanese version of the Internet Addiction Test (JIAT) for screening for IA in adolescents. **Method**: 299 college students were divided into two groups (Internet Addiction group: IAG and Non-Internet Addiction group: NIAG). A self report questionnaire was employed. **Results**: The IAG showed more problematic Internet use and poorer mental health than the NIAG. The JIAT showed good reliability and validity. To identify IA, we set the cut-off of the JIAT at > 53. **Conclusions**: 5.0% of Japanese college students were identified as internet addicted, and they exhibited poor mental health. The JIAT can be useful as a screening tool for IA.

Keywords: Internet addiction, Japanese college students, mental health, prevalence, screening

Introduction

There is a consensus among researchers that Internet addiction (IA) DOES exist (Chou, Condron, & Belland, 2005), although there is no standardized definition of IA, or the other researchers reported some critical considerations regarding IA (Shaffer, Hall, & Vander Bilt, 2000).Young cautiously concluded that there are increasing numbers of people with IA not only in the United States, but also in other developed countries (Young, 1996; Young, 1998). Since Young's description of IA, many studies of IA have been conducted around the world (Beard & Wolf, 2001; Johansson & Gotestam, 2004; Nalwa & Anand, 2003; Shapira, Goldsmith, Keck, Khosla, & McElroy, 2000). In many studies, the target populations are adolescents, who comprise the majority of Internet users. In northeastern Asia, researchers have focused on IA from diverse perspectives (Tsai & Lin, 2003; Whang, Lee, & Chang, 2003). More recently, a relationship between IA and attention-deficit/hyperactivity disorder (AD/HD) was reported (Yoo et al., 2004), and many other researchers have also reported on issues relevant to IA. The other researchers reported relationships between IA and AD/HD, substance abuse, and other psychiatric symptoms (Yen et al., 2008; Yen, Ko, Yen, Wu, & Yang, 2007). With the explosive development in information technology at the beginning of the 21st century, IA seems as if it is becoming more widespread and more serious.

In Japan, the percentage of Internet users in the population has been similar to those of other developed countries since the beginning of the Internet era. Several studies relevant to IA have been conducted in Japan (Shimai & Deguchi, 2001; Wada, 2002), but as far as we know, none have defined IA as a mental disorder. Since it has not yet seen as a mental disorder, IA studies have been fewer in Japan than in other countries. Because Japan is one of the leading countries in the IT field, there are as many Internet users in Japan as in countries where many IA studies have been conducted. In this regard, Japan lags behind in the field of IA research, although the proportion of the Japanese population suffering from IA is suspected to be similar to those in other countries. Until now, we have not known how many Japanese individuals can be regarded as suffering from IA.

College students, who comprise the majority of Internet users, face multiple stressors, such as academic overload, constant pressure to succeed, competition with peers, and in some countries, financial burden and concerns about the future. As this severe stress may lead to psychopathology, the health of university/college students has been the subject of increasing focus (Tosevski, Milovancevic, & Gajic, 2010). University/college students can be regarded as vulnerable to mental health problems and socially maladaptive behaviors

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(Kitzrow, 2003). Indeed, Scherer reported college students' problematic Internet use (Scherer, 1997). Hence, focusing on university/college students is important for prevention of their specific problems.

Although Japanese use of technology is greater than most other nationalities, IA relevant researches have not been comprehensively conducted in Japan. In addition, college students often experiences fully unmonitored use of Internet for the first time when entering college. It is imperative to investigate IA in Japanese adolescents. In the present study, we investigated IA, and examined the utility of the Japanese version of Young's Internet Addiction Test for screening for IA in Japanese college students. As mentioned above, in many previous studies, the target populations were adolescents. Hence, as representatives of adolescents, we targeted college students, who also tend to be susceptible to mental health problems as well as engaging in socially maladaptive behaviors. In light of prior research, Internet-addicted college students may be at risk for comorbid mental health problems. Detecting IA in Japanese college students could be the first step in protecting them from other mental health problems. Precise screening would also allow us to estimate how many Japanese adolescents suffer from IA.

Method

Participants

Over a period of four weeks, we asked a total of 350 students to complete paper-based questionnaires. The participants were recruited in their regular classes. It took about 20 minutes for them to fill out the questionnaires. The questionnaires were collected from the students after they finished answering all of the questions at the end of the classes. A total of 299 (184 males and 115 females) usable questionnaires were returned, yielding an effective response rate of 85.4%. The mean age of the participants was 19.4 years ± 2.67, with no statistical difference between males and females.

Measures

A self-report questionnaire was employed to measure demographic information (e.g., age, gender), Internet use and addiction, and psychological characteristics previously associated with excessive Internet use (Widyanto & McMurran, 2004).

Internet Use

The participants were asked the following two questions about their Internet use: *How long do you spend online per day? Which device do you usually use for accessing the Internet, a personal computer (PC) or a mobile phone, including "Smartphones"?* We also asked a multiple-answer question about the purposes of respondents' Internet use. According to a survey of Japanese telecom use, among Japanese adolescents, "Sending and receiving e-mails," "Browsing personal websites, blogging, and using social networking services (SNS)," "Searching for information," "Shopping and/or gaming," and "Looking at, listening to or downloading digital content" were the five most common purposes of Internet use (Ministry of Internal Affairs and Communications, 2009).We created the following multiple-answer question about Internet use based on the survey: *Choose the purpose(s) of your Internet use*: *"Sending and receiving e-mails," "Browsing personal websites, blogging, and using social networking services (SNS)," "Searching for information," "Shopping and/or gaming," and "Looking at, listening to or downloading digital content"*.

Young's Diagnostic Questionnaire (YDQ) of IA

Young's Diagnostic Questionnaire (YDQ) of IA, which Young developed by referencing and modifying the diagnostic criteria of Pathological Gambling in DSM-IV-TR (American Psychiatric Association, 2000) consists of eight items. The YDQ has previously displayed good reliability, consistency, and unidimensionality (Johansson & Gotestam, 2004). According to Young, a score of 5 or more criteria as measured by the YDQ is classified as Internet dependent (Young, 1996; Young, 2004). After first translating YDQ into Japanese, it was translated back into English by a Japanese-English bilingual professional. In comparison to the original YDQ, almost all of the questions were acceptably similar to the original ones. In the present study, Cronbach's α of Japanese translated YDQ was 0.72, which indicated adequate internal consistency. We used the Young's criteria for IA: Those who answered "yes" to five or more of eight items were clas-

sified as being addicted to the Internet. The participants were divided into two independent groups using the criteria. Fifteen students scored five or more on the YDQ. We labeled those 15 students the IA group (IAG) and the other 284 the Non-IA group (NIAG).

Japanese version of the Internet Addiction Test (JIAT)

Since Odajima had already translated the original Internet Addiction Test (IAT) into Japanese in her book (Young, 1998), we had it translated into English by the above-mentioned Japanese-English bilingual professional. We confirmed that each back-translated item was acceptably similar to Young's original IAT. Hence, in the present study, we used the Japanese version of the IAT as translated by Odajima. We received approval for using it for research purposes from Young. According to Chang and Law, the IAT shows not only strong internal reliability across studies, but also good construct validity (Chang & Law, 2008). The IAT is a 20-item questionnaire that measures mild, moderate, and severe levels of IA. Each question is answered using the following scale: 1 = Rarely, 2 = Occasionally, 3 = Frequently, 4 = Often, 5 = Always. We adapted the same scoring procedure to the JIAT, yielding a range of possible total scores from 20 to 100.

The 12-Item General Health Questionnaire (GHQ-12)

The General Health Questionnaire (GHQ) was employed to evaluate the negative mood states of depression, anxiety, and stress, subjective feelings of social isolation or loneliness, denial, and behavioral disengagement. The scale asks whether the respondent has recently experienced a particular symptom or behavior. Each question is self-rated on a four-point scale (less than usual, no more than usual, rather more than usual, or much more than usual). In this study, the 12-item GHQ (GHQ-12) was used. The most common scoring methods are Likert scoring (0-1-2-3) and bi-modal scoring (0-0-1-1). The methods produce total scores of 36 or 12, respectively. Since the GHQ-12 is brief, simple, and easy to complete, its application in research settings as a screening tool for poor general health conditions has been well-documented. There is evidence that the GHQ-12 is a consistent and reliable instrument when used in general population samples (Pevalin, 2000). In Japan, GHQ-12 has been reported to be usable with a cut-off score set at 4 or greater, when using a bi-modal scoring method (Honda, Shibata, & Nakane, 2001). In this study, we also applied a bi-modal scoring method for the purpose of determining whether the participants were mentally healthy.

Statistical analyses

First, we compared the IAG and NIAG on age, gender, online time, purposes of Internet use, and total scores of the JIAT and GHQ-12. T-tests were conducted for continuous variables, while the χ^2 test was used for categorical data. For comparison of continuous data, we also calculated r as a measure of effect size. Second, we calculated Cronbach's α for internal consistency for all participants' responses to the 20 questions of the JIAT. Third, we used a t-test to compare the total scores between the IAG and NIAG for discriminative validity. Fourth, in order to investigate the dimensionality of the JIAT, we conducted exploratory factor analysis with promax rotation using all of the participants' data. We also used Eigenvalues and Scree plots to determine the number of factors to be extracted. Finally, we explored the cut-off of the JIAT for detecting IA based on sensitivity and specificity for differentiation by YDQ. We set the cut-off in order to minimize the total of false positive and false negative rates. Meanwhile, positive predictive values (PPV), negative predictive values (NPV), likelihood ratio (LR) positive, and LR negative were calculated and examined for the optimal cut-off. We also used a receiver operating characteristics (ROC) curve, which shows how the true positive rate (sensitivity) (vertical axis) varies with the false positive rate (1-specificity) (horizontal axis), as the decision criterion is varied. We calculated the area under the ROC curve (AUC), standard error and 95% confidence interval (CI). According to Swets, AUC is described as a better measure of predictive accuracy than sensitivity and specificity, as it yields an index independent of the cut-off point and prevalence. He suggests that areas of 0.5 to 0.7 indicate low test accuracy, 0.7 to 0.9 moderate accuracy and > 0.9 high accuracy (Swets, 1988, 1996). The differentiating value of a diagnostic test (YDQ in this study) is optimal when a cut-off is chosen at the point where the

ROC curve is in the nearest left upper corner. The level of significance was set at $p < .05$ (two-tailed). SPSS 16.0 for Windows software was used to conduct the statistical analyses.

Ethical consideration

We asked all respondents to fill out a written consent form to participate in the study in compliance with the Declaration of Helsinki. Before we distributed the questionnaires, we received permission to conduct the survey from the instructor of each class.

Results

There were no significant differences in age or gender ratio between the IAG and NIAG (see Table 1). The percentage of females in the IAG was 33.3% (5 of 15), whereas in the NIAG it was 38.7% (110 of 284). There was no significant difference in gender distribution between the IAG and NIAG. In terms of purposes of Internet use, the IAG showed significantly longer online time than the NIAG. The IAG used PCs rather than mobile phones when accessing the Internet, while the NIAG preferred using mobile phones to PCs. The IAG also reported significantly more Internet use for the purposes of browsing personal websites, blogging, using SNS, and searching for information than their NIAG counterparts.

Cronbach's α of the JIAT was 0.93, which showed very strong internal consistency. The IAG showed significantly higher scores on the JIAT and GHQ-12 than the NIAG. Both groups showed GHQ-12 scores above the cut-off. In addition, the IAG showed significantly higher scores on all of the questions of the JIAT than the NIAG (see Table 2).

We submitted all 20 items of the JIAT to factor analysis. Using the latent root criterion for retaining factors

Table 1 *Comparison of age, gender, Internet use relevant data, JIAT, and GHQ-12 between the Internet Addicted and Non- Internet-Addicted Groups*

	Addicted Group	Non-Addicted Group	t (297)	p	Effect size
	$n = 15$	$n = 284$			r
Age (years)	19.5	19.4	.184	.911	.011
Gender (%)			.175†	.790	−
male ($n = 184$)	5.40	94.6			
female ($n = 115$)	4.30	95.7			
Online time (minutes)	210	65.2	5.34	<.001	.300
Device for accessing Internet (%)			4.53†	.033	−
Personal computer	66.7	39.0			
Mobile phone	33.3	61.0			
Purpose of Internet use ‡ (%)					
E-mail	60.0	77.5	2.42†	.206	−
Browsing websites	93.3	61.6	6.16†	.012	−
Searching for information	26.7	4.90	11.9†	.008	−
Shopping, gaming	0.06	8.50	1.38†	.385	−
Digital content	33.3	21.8	1.08†	.339	−
JIAT total score	61.6	30.3	12.9	<.001	.600
GHQ-12 total score §	5.78	4.01	2.02	.044	.116

JIAT: Japanese version of Internet Addiction Test
GHQ-12: The 12-Item General Health Questionnaire
† χ^2
‡ Multiple-answer
§ Using bi-modal scoring method

Table 2 *Comparison of gender ratio and scores of the JIAT between Internet Addiction group (IAG) and Non-Internet Addiction group (NIAG)*

JIAT	IAG	NIAG	*t*	effect-size
	n = 15	*n* = 284[a]	*df* = 297[a]	*r*
Q 1. How often do you find that you stay on-line longer than you intended?	4. 47	2. 61	6. 45	. 35
Q 2. How often do you neglect household chores to spend more time on-line?	3. 40	1. 67	6. 78	. 37
Q 3. How often do you prefer the excitement of the Internet to intimacy with your partner?	2. 87	1. 33	8. 71	. 45
Q 4. How often do you form new relationships with fellow on-line users?	2. 33	1. 34	5. 05	. 28
Q 5. How often do others in your life complain to you about the amount of time you spend on-line?	3. 00	1. 30	8. 62	. 45
Q 6. How often do your grades or school work suffer because of the amount of time you spend on-line?	3. 27	1. 47	8. 08	. 43
Q 7. How often do you check your e-mail before something else that you need to do?	3. 53	2. 16	4. 13	. 23
Q 8. How often does your job performance or productivity suffer because of the Internet?	3. 13	1. 50	7. 30	. 39
Q 9. How often do you become defensive or secretive when anyone asks you what you do on-line?	3. 47	1. 70	6. 28	. 34
Q10. How often do you block out disturbing thoughts about your life with soothing thoughts of the Internet?	3. 20	1. 27	11. 6	. 56
Q11. How often do you find yourself anticipating when you will go on-line again?	3. 60	1. 61	8. 21	. 43
Q12. How often do you fear that life without the Internet would be boring, empty, and joyless?	3. 13	1. 69	5. 59	. 31
Q13. How often do you snap, yell, or act annoyed if someone bothers you while you are on-line?	2. 60	1. 43	5. 71	. 31
Q14. How often do you lose sleep due to late-night log-ins?	3. 80	1. 62	8. 78	. 45
Q15. How often do you feel preoccupied with the Internet when off-line, or fantasize about being on-line?	2. 27	1. 12	10. 5	. 52
Q16. How often do you find yourself saying "just a few more minutes" when on-line?	3. 00	1. 54	5. 80	. 32
Q17. How often do you try to cut down the amount of time you spend on-line and fail?	3. 40	1. 39	9. 68	. 49
Q18. How often do you try to hide how long you've been on-line?	2. 60	1. 25	7. 33	. 39
Q19. How often do you choose to spend more time on-line over going out with others?	2. 33	1. 17	9. 10	. 47
Q20. How often do you feel depressed, moody, or nervous when you are off-line, which goes away once you are back on-line?	2. 20	1. 11	11. 2	. 54
Total	61. 6	30. 3	12. 2	. 58

JIAT: The Japanese version of Internet Addiction Test

[a] *The numbers vary due to missing data.*

with Eigenvalues greater than 1. 0 and the Scree plot, a three-factor structure was identified, with the extracted factors explaining 58. 2% of the total variance. We labeled these three factors as "Social interactive problems," "Virtual reality," "Obsession and difficulty of impulse-control" Table 3 shows a pattern matrix of the three factors, factor loadings of each item, and factor correlations. The Cronbach's α values of each factor were 0. 91, 0. 75, and 0. 78, respectively. These values showed good internal consistency and reliability.

For each total score of the JIAT, sensitivity, specificity, PPV, NPV, LR positive, and LR negative were determined. In Table 4, the results of the calculations are partly given for the total scores of the JIAT between 50 and 65. Because all of IAG showed more than 50, while all of NIAG scored less than 65, we presented

Table 3 *Factor Analysis of the Japanese version of Internet Addiction Test*

Items	Factor loadings		
	1	2	3
Q 1 How often do you find that you stay on-line longer than you intended?	. 38	−. 02	**. 40**
Q 2 How often do you neglect household chores to spend more time on-line?	**. 56**	−. 002	. 32
Q 3 How often do you prefer the excitement of the Internet to intimacy with your partner?	**. 45**	. 35	−. 03
Q 4 How often do you form new relationships with fellow on-line users?	. 18	**. 36**	. 02
Q 5 How often do others in your life complain to you about the amount of time you spend on-line?	**. 54**	. 35	−. 17
Q 6 How often do your grades or school work suffer because of the amount of time you spend on-line?	**. 63**	−. 01	. 18
Q 7 How often do you check your e-mail before something else that you need to do?	. 03	−. 15	**. 64**
Q 8 How often does your job performance or productivity suffer because of the Internet?	**. 48**	−. 15	. 47
Q 9 How often do you become defensive or secretive when anyone asks you what you do on-line?	**. 94**	−. 11	−. 08
Q10 How often do you block out disturbing thoughts about your life with soothing thoughts of the Internet?	**. 59**	. 29	−. 13
Q11 How often do you find yourself anticipating when you will go on-line again?	. 26	**. 31**	. 20
Q12 How often do you fear that life without the Internet would be boring, empty, and joyless?	−. 30	. 27	**. 77**
Q13 How often do you snap, yell, or act annoyed if someone bothers you while you are on-line?	−. 04	. 20	**. 52**
Q14 How often do you lose sleep due to late-night log-ins?	. 29	. 06	**. 49**
Q15 How often do you feel preoccupied with the Internet when off-line, or fantasize about being on-line?	−. 03	**. 69**	. 06
Q16 How often do you find yourself saying "just a few more minutes" when on-line?	**. 40**	. 12	. 21
Q17 How often do you try to cut down the amount of time you spend on-line and fail?	**. 43**	. 05	. 27
Q18 How often do you try to hide how long you've been on-line?	**. 60**	. 12	−. 11
Q19 How often do you choose to spend more time on-line over going out with others?	. 11	**. 76**	−. 06
Q20 How often do you feel depressed, moody, or nervous when you are off-line, which goes away once you are back on-line?	−. 03	**. 78**	. 09
Factor Correlations 1	1. 00	. 65	. 70
Factor Correlations 2	. 65	1. 00	. 62
Factor Correlations 3	. 70	. 62	1. 00

Factor 1: Social interactive Problems
Factor 2: Virtual Reality
Factor 3: Obsession and Impulsion

Table 4 *Calculations of the Japanese vervion of Internet Addiction Test (JIAT) sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and likelihood ratio (LR positive and LR negative) of the Young's Diagnostic Questionnaire, with* ≥ 5 *as the criterion*

JIAT total score (n = 299)	Sensitivity	Specificity	PPV	NPV	LR positive	LR negative
50	0. 93	0. 96	0. 54	0. 99	23. 3	0. 07
51	0. 87	0. 96	0. 57	0. 99	21. 8	0. 14
52	0. 87	0. 97	0. 62	0. 99	29. 0	0. 13
53	0. 87	0. 98	0. 72	0. 99	43. 5	0. 13
54	0. 67	0. 99	0. 71	0. 98	67. 0	0. 33
55	0. 67	0. 99	0. 71	0. 98	67. 0	0. 33
56	0. 67	0. 99	0. 71	0. 98	67. 0	0. 33
57	0. 67	0. 99	0. 77	0. 98	67. 0	0. 33
58	0. 60	0. 99	0. 82	0. 98	60. 0	0. 40
59	0. 60	0. 99	0. 82	0. 98	60. 0	0. 40
60	0. 60	0. 99	0. 82	0. 98	60. 0	0. 40
61	0. 60	0. 99	0. 82	0. 98	60. 0	0. 40
62	0. 47	0. 99	0. 78	0. 97	47. 0	0. 54
63	0. 40	0. 99	0. 75	0. 97	40. 0	0. 61
64	0. 40	0. 99	0. 86	0. 97	40. 0	0. 61
65	0. 40	1	1	0. 97	−	0. 60

this limited range. By and large, Table 4 reveals that as the total score of the JIAT increases, sensitivity decreases, PPV increases, while specificity and NPV are fairly stable. Table 4 also shows the results for LRs. Findings of LR positive and LR negative values ranged respectively from 23. 3 and 0. 07, associated with the total score of the JIAT of 50, to 40. 0 and 0. 61, which are associated with respectively the total score of the JIAT of 65. For a positive test result, LR positive should be greater, ideally much greater, than 1, while for a negative test result, LR negative should be much less than 1 (Henderson, 1993). In addition, to determine the appropriate cut-off, it is very important to have high sensitivity and PPV, because a positive result will probably lead to diagnosis of IA. Considering these reasons, we set as cut-off the total score of the JIAT > 53, based on sensitivity of 0. 87, PPV of 0. 72, LR positive of 43. 5, and LR negative of 0. 13. In Figure 1, the ROC curve shows the optimum cut-off of the JIAT for detecting IA according to YDQ. Total scores of the JIAT (50, 53, 58, 65) are indicated on the curve in Figure 1 and show that, as the cut-off point decreases, sensitivity increases and specificity decreases. As we set the optimum cut-off as > 53 (sensitivity = 0. 87; specificity = 0. 98; PPV = 0. 72; NPV = 0. 99), the AUC for the JIAT was 0. 987. Based on Swets (1988), this means that the JIAT has high diagnostic accuracy. The standard error was 0. 005 and the 95% CI is 0. 98–1. 00. The 95% CI does not incorporate 0. 5, showing that the CDS predicts IA better than chance. Eventually, discriminative predicted value was 95. 6% based on the cut-off as > 53.

Discussion

In the present study, we recruited participants at one institution, which was a "middle level" private university in Japan. Thus, our sample may represent "average" Japanese adolescents. We used a convenience sampling method for recruiting our target population, which was matched with data on the demographics of Japanese Internet users. In Japan, according to the Ministry of Internal Affairs and Communications, the gender ratio (male vs. female) of adolescent Internet users is about 3 : 2 (male, 58%; female, 42%) (Ministry of Internal Affairs and Communications, 2009). In our sample, the ratio was 8 : 5 (male, 62%; female, 38%), which is approximately equal to the ratio reported by the national survey. Hence, our sample could be re-

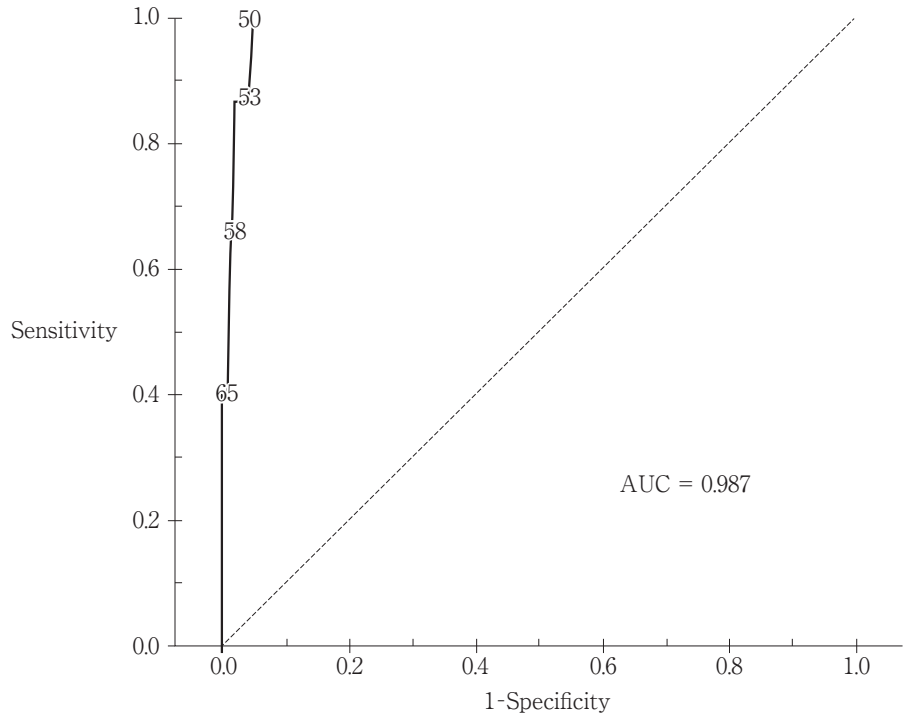

Figure 1 *ROC curve of the Japanese version of Internet Addiction Test*
AUC: area under the curve

garded as representative of Japanese youth.

According to Shaw and Black, several surveys have been conducted to estimate the prevalence of IA in different countries (Shaw & Black, 2008). Most studies have focused on younger populations rather than the wider adult population, perhaps reflecting the view that IA is primarily a disorder of younger persons. IA prevalence estimates range from 0.9% to 38%, while reported relationships of IA with gender vary. Various studies have reported a majority of males or a majority of females, while others have found an equal gender distribution (Shaw & Black, 2008). Recently, Pallanti, Bemardi, and Leonardo reported an IA prevalence of 5.4% based on 275 Italian students, with IA affecting both genders equally (Pallanti, Bernardi, & Quercioli, 2006). In the present study, with a similar sample size as the Italian study, the prevalence rate was 5.0% (15 out of 299), and the prevalence in each gender was almost equal (male vs. female; 5.4% vs. 4.3%). Some previous studies reporting a majority of males with IA were conducted prior to 2005. As far as we know, since 2006, no data showing a preponderance of males in the IA population have been reported. Because the variety of uses for the Internet has expanded, more females have begun to use the Internet than ever. For example, women seem especially interested in SNS and online shopping (Ministry of Internal Affairs and Communications, 2009). In sum, the Japanese IA prevalence rate found in this study is almost the same as those reported for Taiwan, Korea, Italy, and the United States. Although it is difficult to generalize our results beyond their immediate context, this study is the first to investigate IA in the Japanese context. We will need more data to confirm our results in the general population in the future.

As might be expected, the IAG spent significantly more time online than the NIAG. We found that regardless of IA status, checking e-mail seemed to be very common in Japanese college students, but individuals in the IAG showed evidence of distinctive behavior patterns, which were related to three factors of the JIAT found in this study. In the present study, the IAG used the Internet more than the NIAG for the purposes of "Browsing personal websites, blogging, or using SNS" and "Searching for information." The former seems to relate to Factor 1 "Social interactive problems" and Factor 2 "Virtual reality," while the latter relates to Factor 3 "Obsession and difficulty of im-

pulse-control." Social interactive problems may have been affected by the development of SNS. In Japan, the most popular SNS is *mixi*, which exceeded 20 million users in 2010, the majority of whom are college/university students (Mixi, 2010). Using SNS, we can even find and meet with friends and virtually socialize. Users of SNS can easily become acquainted with others (even strangers) via the Internet. They can frequently "meet" each other online to exchange information without meeting in the real world. This study confirmed that many Japanese college students used SNS, possibly causing the IAG to develop Social interactive problems and to addict to Virtual reality. In terms of "Searching for information," students are accustomed to using the Internet to gather relevant information not only for their own interests, but also for their studies and assignments. However, compared with the NIAG, the IAG tended to unnecessarily and obsessively spend excessive time on the Internet beyond that required for gathering information.

Generally, if Cronbach's α is more than 0.70, internal consistency can be regarded as good. Since Cronbach's α was as strong in this study as in previous studies, we confirmed the reliability of the JIAT. This also validated our use of the total score of the JIAT to classify individuals as IA. Members of the IAG had significantly higher scores on all items of the JIAT than did members of the NIAG. The JIAT had discriminative validity, meaning that the scale adequately differentiated between the two groups.

As a screening tool, the JIAT can be regarded as usable in the Japanese population. We set the cut-off score as >53 out of 100, with very high sensitivity. Generally, sensitivity is primarily considered for setting cut-off scores when the prevalence rate of the disease is low. Not only in our sample, but also in previous studies, prevalence rates of IA were not high enough that predictive values had to be considered. However, a condition with a relatively low prevalence rate is bound to yield high false positive rates that exceed false negative rates. In such a circumstance, a limited positive predictive value yields high false positive rates, even in the presence of a specificity that is very close to 100% (Agresti, 1996). In the present study, the specificity was almost 100%, which may have pointed toward high false positive rates of the JIAT. However, due to a low prevalence of IA, we had to primarily consider sensitivity for the screening tool rather than lessening a false positive rate. We were at least able to show usability of the JIAT as a screening tool for IA. We will still need evidence-based research for refining the JIAT using samples representative of the larger general population in Japan. Although we believe that SNS are convenient and very useful, indeed, some related problems have been reported (Ybarra & Mitchell, 2008). To prevent them from the problems, we have to find out the IAG as soon as possible. The JIAT

We found that the IAG showed significantly poorer mental health status than the NIAG. We could not determine which problem came first, IA or poor mental health. IA might have triggered mental health problems; on the other hand, poor mental health conditions, such as depressive mood, might have caused IA. According to the existing literature, individuals with IA commonly exhibit comorbid mental health problems (Yen et al., 2008; Yen et al., 2007; Yoo et al., 2004), antisocial behaviors, and forensic issues (Recupero, 2008). Empirically, we can at least suggest that mental health professionals use the JIAT for screening for IA in college students who have already been diagnosed with other mental health problems. This may permit the IA to be treated before the problem becomes serious.

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